

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (previously presented): A system for predicting roller cone drill bit failure, comprising:
 - a drill string having a drill bit;
 - a plurality of sensors connected to collect strain data from said drill bit;
 - and
 - circuitry for calculating relative changes in strain between said sensors;
 - wherein said strain data is used by said circuitry to calculate relative changes in strain between said sensors to thereby predict bit failure.
2. (original): The system of Claim 1, wherein said relative changes in strain between said sensors is used to determine bit condition.
3. (previously presented): A system for predicting drill bit failure, comprising:
 - a drill string having a down hole sub assembly, said sub assembly including a plurality of sensors which measure strain;
 - circuitry for calculating relative average strain among said sensors; and
 - a drill bit removably attached to said sub assembly;
 - wherein strain data from said sensors is used by said circuitry to calculate the relative average strain among said sensors.
4. (original): The system of Claim 3, wherein said relative average strain among said sensors is used to estimate the drill bit condition.

5. (previously presented): A system for detecting roller cone drill bit failure, comprising:

a plurality of sensors on the lower end of a drill string connected to collect data relating to a bending moment of said lower end; and circuitry for calculating changes in average bending moment of said lower end;

wherein said data is used by said circuitry to calculate changes in average bending moment.

6. (original): The system of Claim 5, wherein said changes in average bending moment are used to ascertain drill bit condition.

7. (presently amended): A system for detecting roller cone drill bit failure, comprising:

a plurality of sensors on the lower end of a drill string separate from the drill bit, each of said sensors connected to detect relative change in axial strain at a particular location;

wherein bit failure is indicated when said relative change in axial strain exceeds a predetermined test.

8. (previously presented): A system for detecting roller cone drill bit failure, comprising:

a plurality of sensors on the lower end of a drill string positioned on a sub assembly located above said roller cone drill bit, each of said sensors connected to detect relative change in axial strain at a particular location;

wherein bit failure is indicated when said relative change in axial strain exceeds a predetermined test.

9. (previously presented): A system for detecting drill bit failure, comprising:
a plurality of sensors on the lower end of a drill string connected to
collect strain data from said lower end, said lower end having a
drill bit with one or more cones; and
circuitry for calculating average load supported by each of said cones;
wherein said strain data is used by said circuitry to calculate the average
load supported by each of said cones.
10. (original): The system of Claim 9, wherein said data is used to ascertain
bit condition during drilling.
11. (canceled)
12. (previously presented): A method for detecting drill bit failure, comprising:
monitoring at least one bending strain in a bottom hole assembly,
wherein said bending strain is measured by sensors located on a
sub assembly located above the drill bit on the drill string; and
dynamically assessing degradation of said bottom hole assembly in
dependence on said bending strain.
13. (previously presented): A method for drilling, comprising:
monitoring at least one bending strain in a bottom hole assembly which
includes a drill bit, wherein said bending strain is measured by
sensors located on a sub assembly located above the drill bit on
the drill string; and
dynamically assessing and signalling degradation of said bottom hole
assembly in dependence on said bending strain.
14. (previously presented): The method of Claim 13, further comprising the
step of halting drilling in dependence on said step of dynamically assessing.

15. (original): A method for drilling, comprising:
monitoring differential cone loading in a roller cone drill bit; and
dynamically assessing and signalling degradation of said drill bit in
dependence on changes in said differential cone loading.
16. (previously presented): The method of Claim 15, further comprising the
step of halting drilling in dependence on said step of dynamically assessing.
17. (currently amended): A method of predicting drill bit failure, comprising
the steps of:
taking multiple strain measurements from an instrumented sub assembly
which is separate from the drill bit; and
deriving information regarding bit wear from relations between said
respective measurements.
18. (previously presented): A method of predicting drill bit failure, comprising
the steps of:
taking multiple strain measurements from an instrumented sub
assembly, wherein said instrumented sub assembly does not
electrically communicate with said drill bit; and
deriving information regarding bit wear from relations between said
respective measurements.
19. (original): A method of predicting drill bit failure, comprising the steps of:
analyzing the relative strain induced on different parts of a bottom hole
assembly during drilling;
predicting drill bit failure based on said relative strain.
20. (original): The method of Claim 19, wherein said bottom hole assembly
comprises a drill bit and an instrumented sub assembly.

21. (original): A method of predicting drill bit failure, comprising the steps of:
- collecting strain data from a plurality of gauges connected to measure strain induced on a drill bit during drilling;
 - computing a ratio of average strain at each said gauge relative to another said gauge;
 - halting drilling when said ratio exceeds a test.